

**ASSESSMENT AND TREATMENT OF STEREOTYPIC VOCALIZATIONS IN A
TAIWANESE ADOLESCENT WITH AUTISM: A CASE STUDY****Ya-Ping Wu***National Taiwan Normal University***Pat Mirenda***University of British Columbia***Hwa-Pey Wang***National Taiwan Normal University***Ming-Chung Chen***National Chiayi University*

This case study describes the processes of functional analysis and modality assessment that were utilized to design a communication intervention for an adolescent with autism who engaged in loud and disruptive vocalizations for most of the school day. The functional analysis suggested that the vocalizations served both tangible and escape functions. The modality assessment suggested that the participant could use a speech-generating device to make requests for a preferred item. Results of the intervention suggested that functional communication training was useful in decreasing the frequency of vocalizations and increasing independent requesting in school and community settings. The results are discussed with regard to their implications for the treatment of stereotypic vocalizations and the limitations of the case study design. We also discuss the importance of international educational efforts related to the dissemination of evidence-based practices such as functional analysis and functional communication training.

Stereotypic behavior has been viewed as one of the core features of autism since Leo Kanner first described the disorder in 1943. Cunningham and Schreibman (2008) suggested that stereotypic behavior could be defined as any behavior that *involves repetition, rigidity and invariance, as well as a tendency to be inappropriate in nature* (p. 470). Stereotypic behaviors take diverse forms and may involve repetitive motor mannerisms (e.g., mouthing of hands or clothing, finger flapping, hand waving, body rocking) or repetitive vocal behaviors (e.g., humming; squealing, making unusual noises). They may or may not cause injury to the person who engages in them (e.g., hand mouthing may cause skin irritation).

Stereotypic behaviors are targeted for intervention for two primary reasons. First, they are often socially stigmatizing and thus limit the extent to which an individual will be included in a wide range of community and social activities (Durand & Carr, 1987). Second, they may interfere with learning opportunities or present as obstacles to learning, especially when they are difficult to interrupt or when they occur during a majority of a person's waking hours (Koegel & Covert, 1972).

Numerous studies have shown that stereotypic behaviors are often maintained by positive automatic reinforcement that is available to the person who engages in them, in the form of pleasurable visual, auditory, tactile, vestibular, gustatory, and/or olfactory sensory feedback (Cunningham & Schreibman, 2008). Stereotypic behaviors that are maintained by automatic reinforcement have been successfully treated with behavioral interventions such as sensory extinction and noncontingent reinforcement. Sensory extinction involves systematically masking the relevant source of sensory feedback (Iwata, Pace, Cowdery, & Miltenberger, 1994; Rincover, 1978). Noncontingent reinforcement involves providing regular, *free* access to socially and contextually appropriate activities that provide similar sensory feedback (Britton, Carr, Landaburo, & Romick, 2002; Piazza, Adelinis, Hanley, Goh, & Delia, 2000; Rapp, 2006, 2007). In fact, until quite recently, there has been a tendency to assume that *all* stereotypic behavior is maintained by sensory consequences, which has led in turn to a *cascade of*

behavioral interventions (Cunningham & Schreibman, 2008, p. 470) that are meant to address this as the presumed function.

An increasing body of literature suggests that stereotypic behavior can also be maintained by social contingencies. Behaviors that are maintained by positive tangible reinforcement result in access to preferred items or activities (Ahearn, Clark, Gardener, Chung, & Dube, 2003). Behaviors maintained by positive social reinforcement result in social attention from an adult or peer (Goh et al., 1995; Kennedy, Meyers, Knowles, & Shukla, 2000; Runco, Charlop, & Schreibman, 1986). Finally, behaviors maintained by negative reinforcement result in avoidance or removal of difficult tasks or demands (Durand & Carr, 1987; Kennedy et al., 2000). Interventions aimed at reducing stereotypic behaviors maintained by reinforcement typically involve teaching one or more functionally equivalent communicative behaviors that serve the same function, a procedure known as functional communication training (FCT). In one of the first published FCT studies, Carr and Durand (1985) used this approach with four children with autism and other developmental disabilities who engaged in a variety of aggressive, self-destructive, and disruptive behaviors. Functional analyses of the children's problem behaviors revealed that they occurred primarily when they were presented with difficult tasks, suggesting that the behaviors were escape-motivated. In addition, for three of the four children, the behaviors occurred when they were provided with low levels of adult attention, suggesting an attention-seeking function as well. The children, all of whom were able to speak, were taught two verbal communicative phrases: (a) *Am I doing good work?*, a phrase designed to elicit adult attention, and (b) *I don't understand*, a phrase designed to elicit adult assistance during difficult tasks. For all four children, there was an immediate and substantial reduction in the frequency of the target behaviors only after they learned the communicative phrase that was relevant to the specific function of their behavior. Over the past 20+ years, FCT has been used successfully to teach alternative replacement behaviors that are communicative in nature to children and adults with a wide variety of disabilities, with concomitant reduction in functionally-related problem behaviors (Bopp, Brown, & Mirenda, 2004; Mirenda, 1997; and Sigafoos, O'Reilly, & Lancioni, 2009).

FCT has also been used to treat stereotypic behavior in a few studies. For example, Day, Rea, Schussler, Larsen, and Johnson (1988) used functional analysis to examine stereotypic head-hitting behavior in an adolescent girl with severe intellectual disability, and found that it served both tangible and escape functions. They then taught the girl to clap her hands to request desired items and to say *no* to terminate undesired activities, and provided her with the relevant contingent reinforcement. Stereotypic behavior decreased considerably as a result of the two instructional interventions. Similarly, for stereotypic behavior that was maintained by attention, escape, and tangible consequences, Kennedy et al. (2000) taught a ten-year-old boy with autism to raise his right hand, sign *break*, and sign *more*, respectively. Results indicated a dramatic decrease in stereotypic behavior across functions once the boy had mastered all three communicative responses.

From these studies, it is clear that identification of the function of stereotypic behavior is essential in order to design an appropriate intervention. Typically, assessment in this regard is achieved through the process of functional analysis, which requires an assessor to create situations in which various environmental conditions that may be related to stereotypic behavior are available for brief periods of time (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982). In each condition, a specific consequence is delivered contingent on the occurrence of stereotypy, to assess its impact on the frequency of the behavior over time. For example, in order to examine whether or not stereotypy is escape-motivated, an individual might be presented with a difficult or unpreferred task. Each time he or she engages in stereotypy, the task is removed temporarily. If the behavior is escape-motivated, it should increase in frequency as long as it is met with the desired consequence (i.e., task escape). Similar assessment contexts can also be set up for tangible, attention, and other functions. Without a functional analysis that examines the entire range of potential functions of stereotypic behavior (i.e., tangible, attention, escape, and positive automatic reinforcement), it is difficult to design individualized, functionally relevant interventions that are likely to be effective.

The purpose of this case study was to add to the existing literature on the use of functional analysis and functional communication training to address stereotypic behavior. The case is unique in that it involved a Taiwanese adolescent with a long history of home care and little previous educational or behavioral treatment who engaged in loud, stereotypic vocalizations for most of his waking hours.

Method

Participant

The participant in this study was Jack, 17-year-old boy who was diagnosed with severe autism at age three by professionals at Taichung Veterans General Hospital in Taiwan. At the time of the study, Jack lived at home with his parents and an older brother. At age five, his parents had enrolled him in a private institution because of severe self-injurious behavior and tantrums, but they withdrew him one month later and then kept him at home until he entered a special school at age 16. Thus, from ages five through sixteen, Jack received no educational or therapeutic supports of any kind. During this time, his parents reported that he slept only one to two hours per night and engaged in frequent self-injurious behaviors (SIB) and both motor and vocal stereotypies (e.g., head banging; scratching/digging his face, arms, and forehead; loud and frequent vocalizations; body-rocking). He also demonstrated severe eating problems and was unable to eat solid foods because his permanent teeth never developed as a result of poor oral hygiene. He survived on a liquid diet that he would only accept from his mother. He insisted on covering his head with his shirt and on covering his hands with his sleeves for most of his waking hours, and he often mouthed his clothes as well. When the study commenced, Jack had no apparent vision or hearing impairments, no verbal language skills, and was unable to follow one-step commands.

At age 16, Jack entered a special school in Taiwan where he was a member of a self-contained classroom with 13 other children who had a variety of disabilities (e.g. moderate or severe intellectual disability, osteogenesis imperfecta, autism, cerebral palsy, etc.). Jack spent most of his day in this classroom, which was staffed by two teachers, a teaching assistant, and a student teacher. During his first year at school, Jack learned to sit on a chair for an entire class period; follow one- and two-step commands; and express basic needs using simple gestures (e.g. pulling an adult's hand to a desired item and nodding his head). He received supports from a special dentist and was taught self-eating and self-drinking skills through the use of oral desensitization techniques and oral muscle massage. His sleeping improved considerably through the use of traditional Chinese medicine.

Jack's body rocking, tantrums, and self-injurious behaviors decreased considerably during his first year in school year through a combination of consequence-based interventions that included response interruption, time-out, extinction, and differential reinforcement. However, his loud and frequent vocalizations continued intermittently for most of the day at home and at school. Consequence strategies such as time out, verbal reprimands, reinforcement of the non-occurrence of problem behavior, and extinction were all ineffective at reducing the frequency of Jack's vocalizations for more than brief periods of time. This behavior negatively affected the quality of Jack's life and that of his family, and limited his ability to access learning opportunities both in and outside of school. As a result, the school staff decided to conduct a functional assessment and brief functional analysis to determine the function of Jack's stereotypic vocalizations and design an appropriate intervention.

Functional Assessment and Functional Analysis

Functional Assessment

The first author conducted separate interviews of Jack's teacher, teaching assistant, and student teacher using the Functional Assessment Interview (FAI) form developed by O'Neill et al. (1997). Information from the FAI was used to identify the ecological events or conditions that appeared to increase the likelihood of Jack's vocalizations (i.e., setting events), the antecedents that triggered his vocalizations, and the consequences that maintained them. Results of the FAI suggested that Jack's vocalizations occurred throughout the day across a variety of situations, but primarily when he was either alone or asked to perform difficult or non-preferred tasks. No clear setting events were identified. Jack's teachers reported that they used a combination of verbal reprimands, ignoring, timeout, and/or response cost (i.e., removal of preferred items or activities) in response to his vocalizations. They hypothesized that the vocalizations were maintained by several possible functions, including automatic positive reinforcement, escape from demands, and attention from adults. Because the function of Jack's problem behavior was not clear based on results of the FAI, a functional analysis was conducted.

Functional Analysis

A multielement design (Sidman, 1960) was used to conduct a brief functional analysis across five conditions: (a) alone, (b) play, (c) attention, (d) demand, and (e) tangible (Iwata et al., 1982). Sessions were conducted in an empty school office at the same time each day, three to five days per week. Each condition was presented once per session for five minutes in random order, with a brief break between

each condition. All sessions were videotaped and two independent observers using a ten-second partial interval observation system recorded data.

Alone Condition

The alone condition was used to assess whether Jack's vocalizations were maintained by positive automatic reinforcement. During this condition, an instructor (the first author) and Jack sat at a table. Jack was not provided with any stimulation (attention, toys, or task demands) for five minutes, regardless of whether stereotypic vocalizations occurred.

Play Condition

The play condition served as a control that was designed to minimize the occurrence of vocalizations. During this condition, Jack was provided with preferred toys and the instructor read a book nearby while he played by himself. If stereotypic vocalizations occurred, the instructor ignored them; however, Jack was praised every 30 seconds if no vocalizations occurred.

Attention Condition

The attention condition assessed the degree to which vocalizations were sensitive to positive reinforcement in the form of instructor attention. During this condition, Jack was provided with preferred toys. The instructor played with him for 30-60 seconds and then read a book nearby while he played by himself. If stereotypic vocalizations occurred, the instructor provided 5 seconds of attention by telling Jack not to make any noise; otherwise, she ignored him.

Demand Condition

The demand condition assessed the degree to which stereotypic vocalizations were sensitive to negative reinforcement in the form of escape from demands. During this condition, the instructor delivered a verbal task demand every 30 seconds by telling Jack to mop the floor, wipe a table, or draw with a marker. Correct responding was praised and incorrect or no responding resulted in a full physical prompt after five seconds. Any occurrence of the stereotypic vocalizations resulted in cessation of task demands for 30 seconds.

Tangible Condition

Finally, the tangible condition assessed the degree to which stereotypic vocalizations were sensitive to positive reinforcement in the form of access to desired items. During this condition, Jack was provided with preferred items (rubber bands) and was allowed to play with them for 30 seconds. Then, the instructor took the rubber bands away and began to read. If vocalizations occurred, the instructor gave the rubber bands to Jack for ten seconds and then removed them once again.

Interobserver Agreement

An independent observer recorded data for 50% of all functional analysis sessions, distributed across conditions. The first author calculated interobserver agreement (IOA) by dividing the number of agreements by the sum of agreements plus disagreements, and multiplying by 100. IOA ranged from 75% to 100%, with a mean of 93.2%.

Results

Results of the functional analysis are summarized in Figure 1.

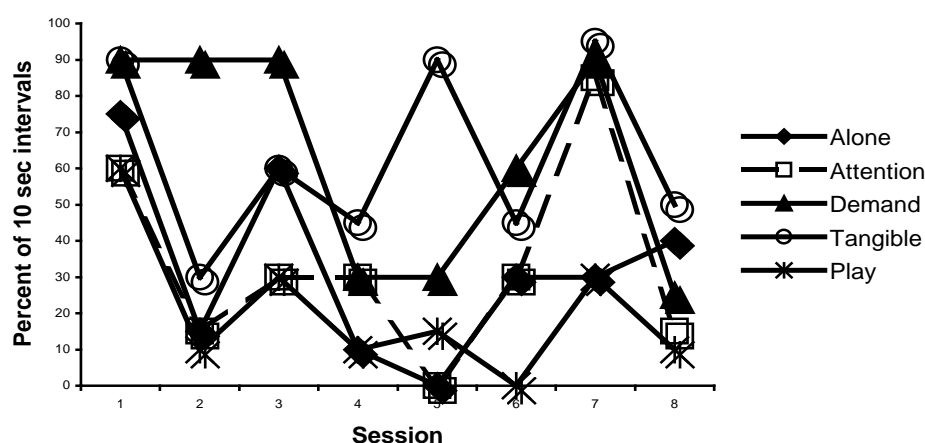


Figure 1.
Percent of 10 sec intervals with loud vocalizations across five conditions.

The percent of ten second intervals with stereotypic vocalizations was highest in both the tangible condition, with a mean of 63.1% and a range of 25%-90%; and the demand condition, with a mean of 63.1% and a range of 30%-95%. In contrast, vocalizations occurred, on average, in 33.1% of intervals in the attention condition, with a range of 0%-85%; 32.5% in the alone condition, with a range of 0%-75%; and 20.6% in the play condition, with a range of 0%-60%. Thus, the functional analysis results suggested that Jack's stereotypic vocalizations were maintained by multiple functions, but primarily by access to preferred items and escape from task demands.

Functional Communication Training

Based on the results of the functional analysis, a decision was made to use functional communication training (FCT) to teach Jack to engage in a communicative behavior that served one of the same functions as his vocalizations. This required an initial modality assessment and subsequent instruction to teach independent requesting.

Modality Assessment

Results of the functional analysis indicated that Jack's vocalizations served both tangible and escape functions; he used them to gain access to preferred items or activities (i.e., tangibles) and to escape or avoid difficult or unpreferred tasks. Before an FCT intervention could be developed to teach alternative replacement behaviors related to these functions, it was necessary to identify an appropriate communication modality for Jack. Because he preferred to keep his hands inside his shirt sleeves (a form of self-restraint that prevented him from engaging in self-scratching and digging), manual signing was not a viable option. Instead, during informal modality assessment trials, Jack was provided with a picture of his favorite object (a rubber band) under two conditions: picture alone and picture plus speech-generating device (SGD). The SGD used for the assessment was the Cardinal, a device with digitized speech that was developed in Taiwan (http://en.unlimiter.com.tw/cardinal_communication-board/).

The assessment was conducted over 15 trials per condition with the order counterbalanced and with 15 minute breaks inserted between conditions. Physical prompts were provided to teach Jack to request the rubber band by either handing the related picture to an adult seated across from him (i.e., picture-exchange) or activating the voice output on the Cardinal by touching a rubber band picture, in response to the question *Do you want to play with the rubber band?* In both conditions, he was provided with a rubber band for ten seconds for both prompted and unprompted trials, with the prompts faded gradually over two sessions. Data were recorded on the frequency of both loud vocalizations and unprompted requesting behaviors in each modality per 15-second interval.

After four sessions, the data suggested a higher percentage of independent requesting behaviors in the SGD condition (mean 61.5%) compared to the picture-exchange condition (mean 38.5%). Conversely, the data suggested a lower percentage of loud vocalizations in the SGD condition (mean 25.5%) than in the picture-exchange condition (mean 43.5%), although these results were more variable than those related to independent requesting. Nonetheless, based on these data, the SGD was selected as the optimal communication modality for intervention.

Instruction and Generalization

Following the modality assessment, additional instruction was provided to teach Jack to use his SGD to make unprompted requests for the rubber band in classroom and community settings. First, in a separate room with no distractions, Jack was taught to: (a) turn on the SGD; (b) pick it up and carry it to the instructor; (c) activate the SGD to request a rubber band; and (d) turn off the SGD after receiving the rubber band. A criterion of 80% correct performance was established before each new step was added. When Jack was able to perform all four steps without prompts in the training setting, he was provided with the SGD in his classroom. A new teacher and a peer were both provided with rubber bands to give to Jack following each unprompted request. When the criterion of 80% correct performance was met in the classroom, four generalization probes were conducted with a new teacher and peer during community outings.

During this phase, two independent observers used a 15 second partial interval system to record the percentage of intervals with independent communication behaviors and stereotypic vocalizations during probe sessions. The mean interobserver agreement was 93% across both dependent variables (range = 90%-95%). Figure 2 displays the results for Jack.

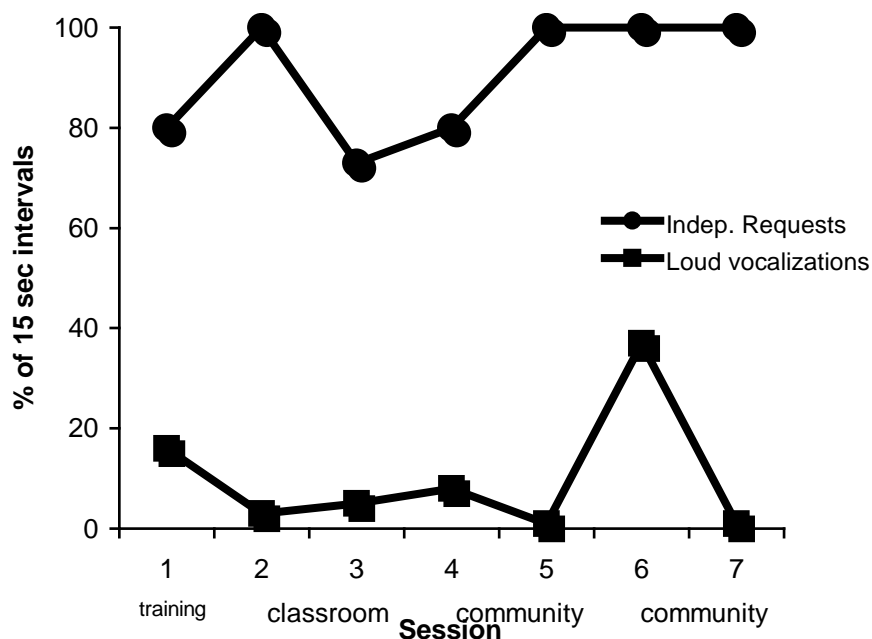


Figure 2.

Percent of 15 sec partial intervals with independent requests and loud vocalizations.

As can be seen in this Figure, independent requesting behaviors occurred during 73% or more of intervals in training, classroom, and community settings, with steady improvement across sessions. Conversely, loud vocalizations occurred at during 8% or fewer of intervals, with the exception of session 6. During this session, Jack was assigned a non-preferred task -- pushing a classmate's wheelchair during a community outing -- and his vocalizations increased to 37% of intervals as a result. His reaction reinforces the functional analysis finding that his vocalizations served an escape function in addition to a tangible function. Unfortunately, Jack graduated from school before an FCT intervention could be implemented to teach him to use his SGD to escape from difficult or non-preferred tasks (e.g., by saying *I need a break*; *I don't want to do this*, or *I need help*).

Discussion

Results of this case study add to the growing body of literature in which functional analysis was used to identify the function(s) of stereotypic behavior. A substantial proportion of this literature has provided evidence for a sensory function of stereotypy, whereby behavior is maintained by positive automatic reinforcement (Rapp & Volmer, 2005). As noted by Cunningham and Schreibman (2008), *this literature contends that social consequences are not operative, and thus has encouraged a cascade of behavioral interventions presuming a predetermined sensory or self-stimulatory function of stereotypy* (p. 470). However, results from a number of studies suggest that stereotypy can also be maintained by positive tangible, positive social, and negative reinforcement (Durand & Carr, 1987; Kennedy et al., 2000; Repp, Felce, & Barton, 1988). This case study provides additional evidence in this regard, using conventional techniques for functional analysis.

Although Jack's informal modality assessment was conducted without experimental controls, it provides an example of the importance of examining learner preferences prior to making a decision about an optimal form of alternative communication. It appeared from this assessment that Jack preferred to use the SGD, either because of the voice output it produced, the fact that it required less physical effort than picture-exchange, or both. Additional research is needed to document the best way to conduct modality assessments to examine learner preferences related to SGDs and other AAC options, using previous research in this regard as models (Sigafoos, O'Reilly, Ganz, Lancioni, & Schlosser, 2005; Son, Sigafoos, O'Reilly, & Lancioni, 2006).

The results of the FCT intervention must be interpreted with caution for a number of reasons. First, no baseline data were recorded on the frequency of Jack's vocalizations prior to the initiation of FCT, aside from the data collected during functional analysis. Thus, it was not possible to compare the

proportion of intervals with vocalizations prior to and during treatment, although the staff at Jack's school reported that it decreased substantially once the SGD was introduced. Second, Jack was only taught to request one item (a rubber band, his favorite object) because the school year ended before additional instruction could be provided. As a result, neither generalization to untrained items nor maintenance over time were assessed, nor was an FCT intervention implemented to address the escape function of his vocalizations that was suggested by the functional analysis. Finally, although inter-observer reliability during FCT was high, the observer was not blind to either the purpose of the study or the treatment condition, which might have resulted in recording bias.

Despite these limitations, this case study provides an example of the use of functional analysis and FCT to treat stereotypic vocalizations in an adolescent with autism who had no previous history of special educational services. Jack's unfortunate situation is not unusual in Taiwan even today, and points to the need for international education efforts that are aimed at dissemination of evidence-based practices to support individuals with severe disabilities. Both functional analysis and FCT have been widely used in Western countries since the 1980s, but educators have only recently incorporated these practices into educational programs in China and other Asian countries (Chiang, 2008). This may be in part because of differences in the causal attributions for student behavior in Western and Eastern societies. For example, Ho (2004) found that Chinese teachers emphasized family factors as the source of students' problem behavior, while Australian teachers placed greater importance on student ability. Similarly, the fact that Jack's family kept him at home from ages five through sixteen suggests that they felt responsible for (and, most likely, ashamed of) his problem behavior and were thus reluctant to seek outside help. International knowledge exchange and knowledge translation efforts are needed to inform both families and educators about educational approaches that have the potential of enabling students like Jack to experience an increased quality of life at home and in the community.

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